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## PRIORITY DOCUMENT

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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

I also certify that the application is now proceeding in the name as identified herein.

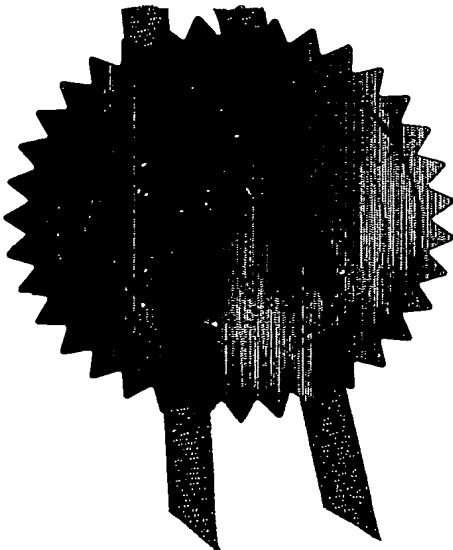
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Signed 

Dated 22 October 2003





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GB 0220814.8

By virtue of a direction given under Section 30 of the Patents Act 1977, the application is proceeding in the name of:

GAIM LTD,  
Hartshorne Road,  
WOODVILLE,  
Derbyshire,  
DE11 7GT,  
United Kingdom

Incorporated in the United Kingdom,

[ADP No. 08715997001]

09 SEP 2002

NEWPORT



0955002 E746644-1 C88531  
PO 0.00-0220814.8

The Patent Office

Cardiff Road  
Newport  
South Wales  
NP10 8QQ

# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

GAIM/2/02

2. Patent application number

(The Patent Office will fill in this part)

0220814.8

17/9/03 - 9 SEP 2002

3. Full name, address and postcode of the or of each applicant (underline all surnames)

① Dr ABDELWAHAB AROUSSE  
17 ELMORE COURT  
RADFORD, NOTTINGHAM  
NG7 4BA 8174591001

③ Dr MDHAMED MENAGER  
42 MANSTON MEWS  
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8450132001

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

② Dr FAYCAL BAHRI  
22 CHARLES AVENUE  
CHILWELL  
NOTTINGHAM NG9 5EE 8452088001

4. Title of the invention

A GENERATOR OF HOMOGENEOUS MIX OF PARTICULATE LADEN FLOWS IN PIPES

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

N/A

Patents ADP number (if you know it)

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

N/A

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

N/A

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- (a) the applicant named in part 3 is not an inventor, or
- (b) the inventor who is not named as an applicant, or
- (c) any named applicant is a corporate body.

See note (d))

NO

# Patents Form 1/77

Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form

Description 1 (ONE)

Claim(s) 1 (ONE)

Abstract 1 (ONE)

Drawing(s) 1 (ONE) only *ll*

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

NONE

11.

I/We request the grant of a patent on the basis of this application.

Signature *[Signature]*

Date 7/9/02

12. Name and daytime telephone number of person to contact in the United Kingdom

DR A. AROUSSI

TEL: 01159 513795

## Warning

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## Notes

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- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered 'Yes' Patents Form 7/77 will need to be filed.
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- For details of the fee and ways to pay please contact the Patent Office.

**Title:**  
**A GENERATOR OF HOMOGENEOUS MIX OF PARTICULATE  
LADEN FLOWS IN PIPELINES**

**Authors:**

Dr. Abdelwahab AROUSSI  
Dr. Faycal BAHRI  
Dr. Mohamed MENACER

**Address:**

GreenBank Advanced Instrumentation and Measurements Ltd.  
Hartshorne Road, Woodville,  
Derbyshire DE11 7GT  
England. UK.

**Abstract.**

Improving the combustion efficiency of pulverized fuel (PF) leads to the considerable reduction of pollutants emissions such as nitrogen oxide (NO<sub>x</sub>). Pulverized fuel is usually transported from the mill in pipes through different bends and chicanes to the burners. During the transportation process these bends act as classifiers of the solid particles. This gives rise to pulverized fuel ropes where the solid phase is distinct from the air phase. On arriving at the splitting points (bifurcations and trifurcations) the PF flow is no longer mixed and could eventually splits into uneven fuel/air ratio to feed different burners. Therefore, this yields uneven combustion in the burners, increasing fuel costs and levels of carbon in the ash as well as the emission of pollutants in the flue gas.

Consequently, it is essential to have a device that breaks the rope and that produces a homogenous distribution of the PF flow before any bifurcation or trifurcation. This application describes such a device.

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**Description**

A passive method designed to break the rope with minimal pressure drop and enhanced control of the PF flow in pipes is herein disclosed. The proposed method is based on sudden and/or gradual variations in the cross sectional areas and or surfaces of the device. These strategically shaped forms will break the rope and yield a homogeneous mix of the PF flow prior to any split in the pipelines. Further the device can be used for any pipe inclination angle. The device can be of any cross section and/or geometry and a possible example of an embodiment is shown in figure 1.

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**Claims**

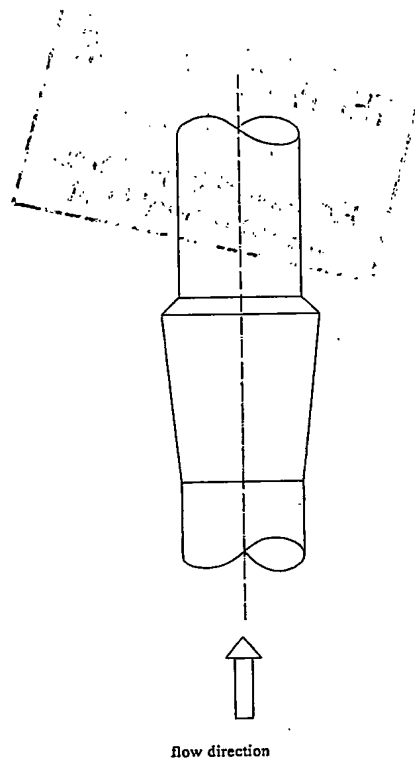
- 1- A passive multi-phase flow mixer device characterized by sudden and/or gradual variations in the cross sectional area or surfaces of vertical, horizontal or inclined pipes as well as in corners and bends.
- 2- A passive multi-phase flow mixer device as stated in claim 1, wherein one or multi changes of the cross sectional areas or surfaces of the device's architecture is embodied.
- 3- A passive multi phase flow mixer device as per claims 1 and 2 wherein different changes of the same or different forms and shapes are combined in line and/or in parallel format.
- 4- A passive multi phase flow mixer device as per claim 3, wherein variation of the cross sectional areas are used to induce mixing and/or induce separation and eliminate and/or reduce and/or increase the particulate drop-out in the vertical, horizontal and inclined pipes as well as in pipe elbows and bends.
- 5- A passive multi phase flow mixer device as claimed in 4 above, where within the device one or all components are made from: metal, glass, plastic, wood, paper, cloth, lather, composite material, abrasion resistant material or ceramic.

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**Drawings.**



**Fig 1: A typical embodiment of the device**